Refraction Worksheet

1. What is the speed of light in flint glass?

$v = ?$
$c = 3.00 \times 10^8 \text{ m/s}$
$n = 1.61$

$n = \frac{c}{v}$

$v = \frac{c}{n}$

$v = \frac{3.00 \times 10^8 \text{ m/s}}{1.61}$

$v \simeq 1.86 \times 10^8 \text{ m/s}$

2. What is the speed of light in quartz?

$v = ?$
$c = 3.00 \times 10^8 \text{ m/s}$
$n = 1.54$

$n = \frac{c}{v}$

$v = \frac{c}{n}$

$v = \frac{3.00 \times 10^8 \text{ m/s}}{1.54}$

$v \simeq 1.95 \times 10^8 \text{ m/s}$

3. The speed of light in an unknown substance is 2.56×10^8 m/s. What is the index of refraction of this substance?

$v = 2.56 \times 10^8 \text{ m/s}$
$c = 3.00 \times 10^8 \text{ m/s}$
$n = ?$

$n = \frac{c}{v}$

$n = \frac{3.00 \times 10^8 \text{ m/s}}{2.56 \times 10^8 \text{ m/s}}$

$n \simeq 1.17$

4. The speed of light is measured at 2.19×10^8 m/s. What substance is the light travelling in?

$v = 2.19 \times 10^8 \text{ m/s}$
$c = 3.00 \times 10^8 \text{ m/s}$
$n = ?$

$n = \frac{c}{v}$

$n = \frac{3.00 \times 10^8 \text{ m/s}}{2.19 \times 10^8 \text{ m/s}}$

$n \simeq 1.37$

Ethyl Alcohol

5. On a distant planet an alien records that light travels 4.6 km in 2.5×10^{-5}s. What substance is the alien atmosphere made out of?

$d = 4.6 \text{ km} = 4600 \text{ m}$
$t = 2.5 \times 10^{-5} \text{ s}$
$v = ?$
$n = ?$

$v = \frac{d}{t}$

$v = \frac{4600 \text{ m}}{2.5 \times 10^{-5} \text{ s}}$

$v = 1.84 \times 10^8 \text{ m/s}$

$n = \frac{c}{v}$

$n = \frac{3.00 \times 10^8 \text{ m/s}}{1.84 \times 10^8 \text{ m/s}}$

$n \simeq 1.63$

Carbon Disulfide

6. What is the distance, in m, of a light year in diamond? Which is greater, a light year in a vacuum or a light year in a diamond? How many times greater is this value?

$d = ?$
$v = ?$
$n = 2.42$
$c = 3.00 \times 10^8 \text{ m/s}$
$t = 1 \text{ year} = 31\,557\,600 \text{ s}$

$n = \frac{c}{v}$

$v = \frac{c}{n}$

$v = \frac{3.00 \times 10^8 \text{ m/s}}{2.42}$

$v \simeq 1.24 \times 10^8 \text{ m/s}$

$v = \frac{d}{t}$

$d = vt$

$d = 1.24 \times 10^8 \text{ m/s} \, (31\,557\,600 \text{ s})$

$d \simeq 3.91 \times 10^{15} \text{ m}$

vacuum is about 2.4 times greater!

7. How long would it take for light to travel through a 5.00 mm zircon?

$c = 3.00 \times 10^8 \text{ m/s}$
$v = ?$
$d = 5.00 \text{ mm} = 5.00 \times 10^{-3} \text{ m}$
$t = ?$
$n = 1.92$

$n = \frac{c}{v}$

$v = \frac{c}{n}$

$v = \frac{3.00 \times 10^8 \text{ m/s}}{1.92}$

$v = 1.5625 \times 10^8 \text{ m/s}$

$v = \frac{d}{t}$

$t = \frac{d}{v}$

$t = \frac{5.00 \times 10^{-3} \text{ m}}{1.5625 \times 10^8 \text{ m/s}}$

$t \simeq 3.20 \times 10^{-11} \text{ s}$